Devising an SLA-Aware Methodology to Improve Process Performance*

Carlos Müller*, Minsu Cho◇, Pablo Fernandez*, Minseok Song◇, Manuel Resinas*, and Antonio Ruiz-Cortés*

* University of Seville, Universidad de Sevilla, Spain.
◇ Pohang University of Science and Technology, Pohang, Korea.

Abstract. Aiming to be as competitive as possible, organisations are always pursuing to improve their business processes applying corrective actions when needed. However, the actual analysis and decision making for those actions is typically a challenging task relying on extensive human-in-the-loop expertise. Specifically, this improvement process usually involves: (i) to analyse evidences to understand the current behavior; (ii) to decide the actual objectives (usually defined in Service Level Agreements -SLAs- based on intuition) and (iii) to establish the improvement plan. In this ongoing work, we aim to propose a data-driven and intuition-free methodology to define an SLA as a governance element that specifies the service level objectives in an explicit way. Such a methodology considers process performance indicators that are analysed by means of inference, optimization, and simulation techniques. In order to motivate and exemplify our work we address a Healthcare scenario.

1 Introduction to our Proposed Methodology

Nowadays, in a changing and competitive business world, organisations must keep their business processes (BPs) under control. In other words, they must analyse if current BPs behaviour is as expected or not. However, such an analysis is not easy to be addressed and automated because it relies on extensive human-in-the-loop expertise in several tasks, namely: (i) to extract information from evidences (such as logs or incidences) to understand the current behaviour; (ii) to decide, based on intuition, the actual objectives in Service Level Agreements (SLAs) that govern the organisation; and (iii) to establish the improvement actions. In this ongoing paper we propose a data-driven methodology that automatically gathers an SLA to govern the organisation activities by means of Service Level Objectives (SLOs). As one of its advantages, our proposal does not requires that a previous SLA were initially defined by organisations. To the contrary, being data-driven, it creates an SLA just from a set of event logs from the

* This work was partially supported by the European Commission (FEDER), the European Union Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie grant agreement No 645751 (RISE_BPM), the Spanish and the Andalusian R&D&I programs (grants TIN2015-70560-R, P12-TIC-1867), the National Research Foundation of Korea (No.NRF-2014K1A3A7A030737007).

current BPs behaviour; and a set of Process Performance Indicators (*PPIs*) [1, 5]. At following we introduce the methodology (c.f. Fig.1) using as running example the processes of a Hospital Inf. System (HIS) without a predefined SLA.

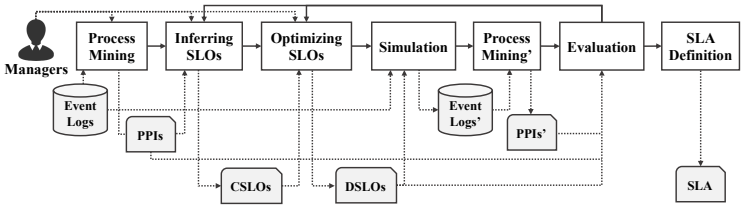

Fig. 1. SLA-Aware Methodology to Improve Organisations Performance.

Initially, we assume that the HIS generates a number of *event logs* including different data (e.g. initial and end moment, state, etc [6]) as result of operating on multiple processes (e.g. regular or emergency room processes, etc) to perform several healthcare activities (e.g. magnetic resonance imaging -MRI-, X-ray, etc). In a **process mining** activity the *event logs* are processed in conjunction with a number of PPIs defined by hospital managers (e.g. "Probability that working time of patients who take MRI test is less than 71 min."). As result of the process mining we would get the measures of all *PPIs* and they are the input of an **inferring SLOs** activity. Such an activity infers the Current Service Level Objectives (*CSLOs* in Fig. 1) for selected, manually or not, PPIs. These *CSLOs* denote the actual current HIS behaviour for the *PPIs* (e.g. "Probability that working time of patients who take MRI test is less than 71 min. is more than 95%") considering some organisational factors involved in the Hospital BPs (e.g. "with 15 employees and 3000$ per employee."). At this point, the *CSLOs* are processed by some optimization techniques in an **optimizing SLOs** activity that gathers a number of desired SLOs (*DSLOs* in Fig. 1) denoting the desired behaviour that Hospital managers would like to achieve. The underlying optimization technique [4, 2] can be configured by Hospital managers considering the mentioned organisational factors. An example of *DSLO* could be "Probability that working time of patients who take MRI test is less than 71 min. is more than 99%") achieved by specific values for the organisational factors (e.g. "with 17 employees and 2700$ per employee."). After that, we propose to analyse if the application of *DSLOs* results in a proper BPs behaviour or not. In doing so, a *simulation* model generated from the initial *event logs* [3] can be modified based on *DSLOs*, then a new set of *event logs* (*event logs'* in Fig. 1) is obtained and it is inputted into a new **process mining'** activity to get the simulated measures of all PPIs (PPIs' in Fig. 1). Then, an **evaluation** activity is performed to analyse the deviation between simulated measures of *PPIs'* and the *DSLOs*. In case of deviation some activities are executed again but with different settings (organisational factors or DSLOs) from the Hospital managers. Specifically, in case of high deviation the **inferring SLOs** activity is executed again; and in

case of low deviation, the **optimizing SLOs** activity is executed again. Finally, if the deviation is negligible, the **SLA definition** activity is performed to gather the document that will govern the BPs in future.

2 Conclusions and Future Work

In this ongoing work we devise an SLA-aware and intuition-free methodology to improve organisations performance that gathers an SLA to govern organisations. The main benefits of our methodology are the following: (i) the SLA is gathered from actual BPs behaviour and not from scratch as traditionally based on managers intuition; (ii) the improvement is assured by simulating and evaluating the processes behaviour before creating the SLA; and finally, (iii) the manual interaction in the whole process is limited to some manual settings (c.f. Fig.2 that depicts our vision of a future tool to help managers in the DSLOs definition).

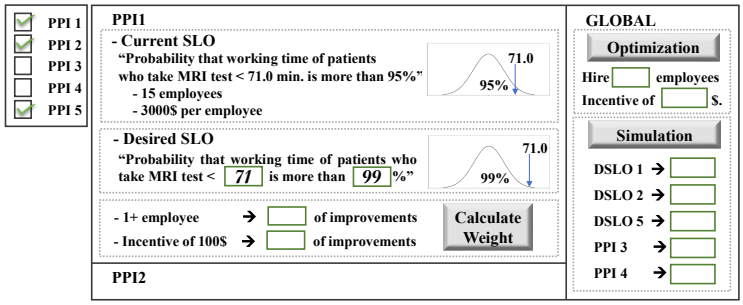

Fig. 2. Mockup of the desired control panel.

References

1. A. del-Río-Ortega, M. Resinas, C. Cabanillas, and A. Ruiz-Cortés. On the definition and design-time analysis of process performance indicators. *Inf. Syst.*, 38(4), 2013.
2. C. Müller, M. Resinas, and A. Ruiz-Cortés. Automated Analysis of Conflicts in WS–Agreement Documents. *Transactions on Services Computing*, 2013.
3. A. Rozinat, R.S. Mans, M. Song, and W.M.P. van der Aalst. Discovering simulation models. *Information Systems*, 34(3):305–327, 2009.
4. A. Ruiz-Cortés, O. Martín-Díaz, A. Durán, and M. Toro. Improving the Automatic Procurement of Web Services using Constraint Programming. *Int. Journal on Cooperative Information Systems*, 14(4), 2005.
5. W.M.P. van der Aalst. Process cubes: Slicing, dicing, rolling up and drilling down event data for process mining. In *Asia Pacific Business Process Management - First Asia Pacific Conference, 2013, Beijing, China, 2013. Selected Papers*, 2013.
6. S. Yoo, M. Cho, E. Kim, S. Kim, Y. Sim, D. Yoo, H. Hwang, and M. Song. Assessment of hospital processes using a process mining technique: Outpatient process analysis at a tertiary hospital. *Int. Journal of Medical Informatics*, 88, 2016.